WHAT IS CLAIMED IS:

1. A substrate provided with a layer of aligned fine particles,

wherein an organic coating film bonded to a surface of the fine particle is formed on the surface of the fine particle,

an organic coating film bonded to a surface of the substrate is formed on the surface of the substrate, and

the organic coating film on the surface of the fine particle is bonded to the organic coating film on the surface of the substrate, whereby the fine particles are immobilized and aligned on the substrate.

2. The substrate provided with a layer of aligned fine particles according to claim 1, wherein an alignment of the fine particles is a single layer of an assembly film.

3. The substrate provided with a layer of aligned fine particles according to claim 1, wherein the fine particles are aligned in form of accumulated layers, and the fine particles are bonded to each other and immobilized.

4. The substrate provided with a layer of aligned fine particles according to claim 1, wherein an average diameter of the fine particles is in a range from 0.5 nm or more to 50 nm or less.

5. The substrate provided with a layer of aligned fine particles according to claim 1, wherein at least one of the organic coating film on the surfaces of the fine particles and the organic coating film on the surface of the substrate is a self-assembling film.

6. The substrate provided with a layer of aligned fine particles according to claim 1, wherein the fine particles are patterned and aligned on the surface of the substrate.

7. The substrate provided with a layer of aligned fine particles according to claim 1, wherein the fine particles are aligned in a concave portion of a concave and convex pattern formed on the surface of the substrate.

8. The substrate provided with a layer of aligned fine particles according to

claim 7, wherein a width of the concave portion is not less than five times and not more than 30 times the average diameter of the fine particle.

9. The substrate provided with a layer of aligned fine particles according to claim 1, wherein the organic coating film on the surface of the fine particle is bonded to the organic coating film on the surface of the substrate with at least one binding selected from the group consisting of covalent bonding, ion bonding, coordinate binding and intermolecular force binding.

10. The substrate provided with a layer of aligned fine particles according to claim 1, wherein the fine particles are at least one selected from the group consisting of metal, metal oxide, semiconductor, an amphoteric element, amphoteric element oxide, and resin.

11. The substrate provided with a layer of aligned fine particles according to claim 1, wherein the fine particles are fine magnetic particles.

12. The substrate provided with a layer of aligned fine particles according to claim 1, wherein

the substrate is formed of at least one material selected from the group consisting of metal, metal oxide, semiconductor, an amphoteric element, amphoteric element oxide, and resin.

13. A method for producing aligned fine particles on a substrate comprising:

forming an organic coating film on a surface of the individual fine particle,

forming an organic coating film on a surface of the substrate, and

allowing the organic coating film on the surface of the fine particle to be in contact with the organic coating film on the surface of the substrate to form a bond between the two organic coating films.

14. The method for producing aligned fine particles according to claim 13,

wherein the process of forming a bond between the organic coating film on the surface of the fine particle and the organic coating film on the surface of the substrate comprises:

irradiating the organic coating film formed on the substrate to form a chemically reactive group in the organic coating film in the irradiated portion,

and

forming a chemical bond with the organic coating film on the surface of the fine particle.

15. The method for producing aligned fine particles according to claim 13, wherein the process of forming a bond between the organic coating film on the surface of the fine particle and the organic coating film on the surface of the substrate comprises:

irradiating the organic coating film formed on the substrate,

removing the organic coating film in the irradiated portion and forming a chemical bond between the organic coating film in a remaining portion on the surface of the substrate and the organic coating film on the surface of the fine particle.

16. The method for producing aligned fine particles according to claim 13, wherein the process of forming a bond between the organic coating film on the surface of the fine particle and the organic coating film on the surface of the substrate comprises:

irradiating partially the organic coating film formed on the surface of the substrate to form a chemically reactive group in the organic coating film in the irradiated portion to form a chemical bond with the organic coating film on the surface of the fine particle, thereby aligning the fine particles only in the energy ray irradiated portion,

irradiating a second portion that had not been irradiated anew to form a chemically reactive group in the organic coating film in the irradiated second portion, and

allowing a different type of fine particles from the fine particles constituting the firstly formed aligned fine particles to be in contact with the surface of the substrate to form a chemical bond with the organic coating film on the surface of the fine particle.

17. The method for producing aligned fine particles according to claim 13, wherein the process of forming a bond between the organic coating film on the surface of the fine particle and the organic coating film on the surface of the substrate comprises:

irradiating the organic coating film formed on the surface of the substrate to form a chemically reactive group in the organic coating film in

the irradiated portion to form a chemical bond with the organic coating film on the surface of the fine particle, thereby forming aligned fine particles in the energy ray irradiated portion, and

irradiating a second portion that had not been irradiated to form a chemically reactive group in the organic coating film in the second irradiated portion, and allowing a same type of fine particles as the fine particles constituting the firstly formed aligned fine particles to be in contact with the surface of the substrate to form a chemical bond with the organic coating film on the surface of the fine particle, thereby aligning the fine particles in accordance with a two-dimensional shape of the first irradiated portion.

18. The method for producing aligned fine particles according to claim 13,

wherein a disk-shaped substrate is used as the substrate, and the organic coating film is first irradiated along a circumference of a concentric circle sharing a center of the disk, thereby aligning the fine particles along the circumference.

19. The method for producing aligned fine particles according to claim 13,

wherein the process of forming a bond between the organic coating film on the surface of the fine particle and the organic coating film on the surface of the substrate comprises:

irradiating the organic coating film formed on the surface of the substrate, removing the organic coating film in the irradiated portion and forming a chemical bond between the organic coating film in a remaining portion on the surface of the substrate and the organic coating film on the surface of the fine particle, thereby forming a structure comprising fine particles in a portion that is not irradiated, and

forming a structure comprising an organic coating on the substrate of the substrate again, and allowing a different type of fine particles from the organic coating film newly formed on the surface of the substrate and the fine particles constituting the firstly formed fine particle layer to be in contact with the surface of the substrate to form a chemical bond with the organic coating film on the surface of the fine particle.

20. The method for producing aligned fine particles according to claim 13,

wherein the process of forming a bond between the organic coating film on the surface of the fine particle and the organic coating film on the

surface of the substrate comprises:

irradiating the organic coating film formed on the surface of the substrate, removing the organic coating film in the irradiated portion and forming a chemical bond between the organic coating film in a remaining portion on the surface of the substrate and the organic coating film on the surface of the fine particle, thereby forming aligned fine particles in a portion that is not irradiated, and

forming a structure comprising an organic coating film on the substrate of the substrate again, and allowing a same type of fine particles as the organic coating film newly formed on the surface of the substrate and the fine particles constituting the firstly formed fine particle layer to be in contact with the surface of the substrate to form a chemical bond with the organic coating film on the surface of the fine particle, thereby aligning the fine particles in accordance with a two-dimensional shape of the irradiated portion.

21. The method for producing aligned fine particles according to claim 13,

wherein the process of forming a bond between the organic coating film on the surface of the fine particle and the organic coating film on the surface of the substrate comprises:

allowing the organic coating film formed on the surface of the substrate to be in contact with the organic coating film formed on the surface of the fine particle to form a chemical bond,

polymerizing the organic coating film formed on the surface of the fine particle to increase an molecular weight of the organic coating film.

22. The method for producing aligned fine particles according to claim 13,

wherein the organic coating film on the surface of the fine particle is bonded to the organic coating film on the surface of the substrate with at least one binding selected from the group consisting of covalent bonding, ion bonding, coordinate binding and intermolecular force binding.

23. The method for producing aligned fine particles according to claim 13,

wherein the organic coating film is a monomolecular film or a polymerized film formed using a monomolecular film as a starting material.

24. The method for producing aligned fine particles according to claim 23,

wherein the monomolecular film is a self-assembling film, and formed of molecules comprising at least one reactive group selected from the group consisting of a thiol group, a chlorosilane group, a coordinate binding group, an isocyanate group and an alkoxysilane group.

25. The method for producing aligned fine particles according to claim 14,

wherein the irradiation is at least one selected from the group consisting of ultraviolet rays, far ultraviolet rays, X-rays, gamma rays, electron rays, and excited plasma.

26. A method for producing a magnetic recording medium on a substrate comprising:

forming an organic coating film on a surface of a fine magnetic particle,

forming an organic coating film on a surface of the substrate,

allowing the organic coating film on the surface of the fine magnetic particle to be in contact with the organic coating film on the surface of the substrate to form a bond between the two organic coating films, and

performing a heat treatment to the fine magnetic particles to increase a coercive force of the fine magnetic particle.

27. The method for producing a magnetic recording medium according to claim 26, wherein before the process of forming the organic coating film on the surface of the substrate, a soft magnetic thin film layer is formed on the substrate by vapor phase rapid quenching.

28. The method for producing a magnetic recording medium according to claim 26, wherein a protective layer further is formed on the surface of the fine magnetic particle layer.

29. The method for producing a magnetic recording medium according to claim 26, wherein particles of the fine magnetic particles have a diameter of 3 nm or more and 50 nm or less.

30. The method for producing a magnetic recording medium according to claim 26, wherein the fine magnetic particles are at least one alloy selected from the group consisting of a FePt alloy and a CoPt alloy.

31. The method for producing a magnetic recording medium according to claim 26, wherein the magnetic field is applied in a direction perpendicular to the substrate plane.

32. The method for producing a magnetic recording medium according to claim 26, wherein the magnetic field is 1 kOe or more.

33. The method for producing a magnetic recording medium according to claim 26, wherein the fine particles have a $L1_0$ structure.

34. A method for producing a magnetic recording medium comprising:

the first process of applying fine particles provided with an organic coating on their surfaces on a non-magnetic substrate directly or via an underlying layer, and

the second process of performing a heat treatment to the fine particles in a magnetic field at a temperature of not less than a Curie temperature of the fine particles.

35. The method for producing a magnetic recording medium according to claim 34, wherein the magnetic field is applied from a direction perpendicular to the substrate plane.

36. A magnetoresistive device,

wherein an organic coating film is formed on a surface of a substrate, the organic coating film being bonded to the surface of the substrate,

an organic coating film is formed on a surface of a fine particle, the organic coating film being bonded to the surface of the fine particle,

aligned fine particles in which the fine particles are immobilized and aligned are formed by bonding the organic coating film on the surface of the fine particle to the organic coating film on the substrate, and

at least a pair of electrodes for passing a current through the fine magnetic particles are formed to change an electrical resistance between the electrodes by an external signal magnetic field.

37. A magnetoresistive head comprising a magnetoresistive device and a shield provided outside the magnetoresistive device,

wherein an organic coating film is formed on a surface of a substrate, the organic coating film being bonded to the surface of the substrate,

an organic coating film is formed on a surface of a fine particle, the organic coating film being bonded to the surface of the fine particle,

aligned fine particles in which the fine particles are immobilized and aligned are formed by bonding the organic coating film on the surface of the fine particle to the organic coating film on the surface of the substrate,

at least a pair of electrodes for passing a current through the fine magnetic particles are formed to change an electrical resistance between the electrodes by an external signal magnetic field, and

the shield is provided for preventing a magnetic field other than the signal magnetic field from entering the magnetoresistive device.

38. A magnetoresistive head comprising a magnetoresistive device and a yoke provided outside the magnetoresistive device,

wherein an organic coating film is formed on a surface of a substrate, the organic coating film being bonded to the surface of the substrate,

an organic coating film is formed on a surface of a fine particle, the organic coating film being bonded to the surface of the fine particle,

aligned fine particles in which the fine particles are immobilized and aligned are formed by bonding the organic coating film on the surface of the fine particle to the organic coating film on the surface of the substrate,

at least a pair of electrodes for passing a current through the fine magnetic particles are formed to change an electrical resistance between the electrodes by an external signal magnetic field, and

the yoke is provided for guiding the signal magnetic field to the magnetoresistive device.

39. A semiconductor device comprising a barrier layer serving as a tunnel barrier layer provided on a semiconductor substrate,

wherein an organic coating film is formed on a surface of the barrier layer, the organic coating film being bonded to the barrier layer,

an organic coating film is formed on surfaces of fine particles, the organic coating film being bonded to the surfaces of the fine particles,

aligned fine particles in which the fine particles are immobilized and aligned are formed by bonding the organic coating film on the surfaces of the fine particles to the organic coating film on the surface of the barrier layer,

the semiconductor device comprising an electrically insulating layer provided on the barrier layer and the fine particle layer.

40. A semiconductor memory device having an insulating gate semiconductor (MIS) type transistor structure comprising a barrier layer serving as a tunnel barrier layer between a gate insulating film of the MIS type transistor structure and a semiconductor substrate, the barrier layer provided on the semiconductor substrate,

wherein an organic coating film bonded to a surface of the substrate is formed,

an organic coating film is formed on surfaces of fine particles, the organic coating film being bonded to the surfaces of the fine particles,

and aligned fine particles in which the fine particles are immobilized and aligned are formed on the surface of the barrier layer by bonding the organic coating film on the surface of the surfaces of the fine particles to the organic coating film on the surface of the substrate.

41. A method for controlling a crystal orientation of fine particles, wherein in a process for ordering fine particles comprising a random alloy, a crystal orientation is controlled by applying a magnetic field at a temperature of a Curie temperature or more.

42. The method for controlling a crystal orientation of fine particles according to claim 41, wherein the fine particles have a diameter of 3 nm or more and 50 nm or less.

43. The method for controlling a crystal orientation of fine particles according to claim 41, wherein the magnetic field is 1 kOe or more.

44. The method for controlling a crystal orientation of fine particles according to claim 41, wherein the fine particles have a $L1_0$ structure.

45. The method for controlling a crystal orientation of fine particles according to claim 41, wherein the fine particles are made of FePT or a CoPt alloy.

46. A method for aligning fine particles, wherein the fine particles provided

with an organic coating film on their surfaces are aligned in a concave portion in a concave and convex pattern formed on a surface of a substrate.

47. The method for aligning fine particles according to claim 46, wherein the fine particles provided with the organic coating film have a diameter of 1 nm or more and 50 nm or less.

48. The method for aligning fine particles according to claim 46, wherein the concave and convex pattern has a cycle of a length of not less than five times and not more than 30 times the diameter of the fine particles.

49. A method for producing a magnetic recording medium on a substrate comprising:

forming a soft magnetic thin film layer on the substrate by vapor phase rapid quenching,

forming an organic coating film on a surface of a fine magnetic particle,

forming an organic coating film on a surface of the substrate,

allowing the organic coating film on the surface of the fine magnetic particle to be in contact with the organic coating film on the surface of the substrate to form a bond between the two organic coating films.

50. The method for producing a magnetic recording medium according to claim 49, wherein a protective layer further is formed on the surface of the fine magnetic particle layer.

51. The method for producing a magnetic recording medium according to claim 49, wherein particles of the fine magnetic particles have a diameter of 3 nm or more and 50 nm or less.

52. The method for producing a magnetic recording medium according to claim 49, wherein the fine magnetic particles are at least one alloy selected from the group consisting of a FePt alloy and a CoPt alloy.

53. The method for producing a magnetic recording medium according to claim 49, wherein the magnetic field is applied in a direction perpendicular to the substrate plane.

54. The method for producing a magnetic recording medium according to claim 49, wherein the magnetic field is 1 kOe or more.

55. The method for producing a magnetic recording medium according to claim 49, wherein the fine particles have a $L1_0$ structure.